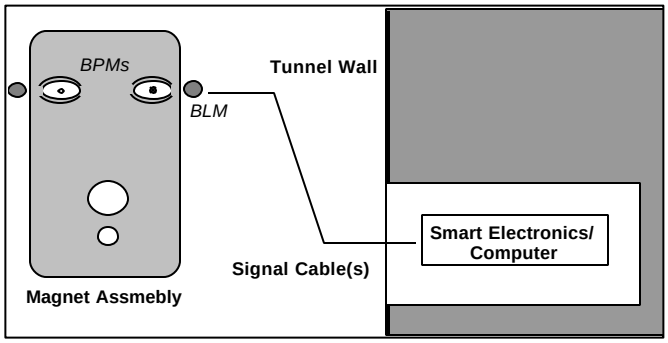
Controls/Communication for 3 TeV Booster, Low-field Option

Working Team: Bob Goodwin, Peter Lucas, Craig McClure, Elliott McCrory and Mike Shea.
Tuesday August 5, 1997

Regular beam instrumentation **concentrated into "lumps"** of electronics. For adequate coverage, **two lumps per period** will be sufficient. For 3 TeV Booster, that will be every **80 meters**. There will be **one computer per lump** which reads/controls **all** the devices in that area of the accelerator. This is a different topology than that which is generally used today. Commercial electronics are used for simplicity and to reduce costs. A really fast local computer does digital signal processing operations; can also be web server.



Item	Number	Data Rate	Unit cost?	Questions/Comments
BPM Pickups	4/period	10 MHz	$500	One per beam * two beams per diagnostics lump; split-cylinder seems best.
BPM Electronics	4/period	10 MHz	$1000	Log amplifiers; DSP done in local PC
BPM Digitizers	4/period	10 MHz	$500	Individual bunches up to 100 nsec/bunch
Loss Monitor	4/period	1 kHz	$500	One per beam * two per period. Continuous.
BLM Digitizers	4-8/period	1 kHz	$500	Used for correctors, too.
Local Computer	2/period	(n/a)	$500	An "IRM" with PowerPC processor
Correctors	2/period	1 kHz		*Details pending...*
Robot?	1	"slow"		Communicates via wireless Ethernet; reads bar codes; camera; wrench; lights; sniffer; temperature; pressure...
Vacuum	@ 150 m	1 kHz		Readout at a lump
Cryo instrumentation	?	?		Similarly, arrange to have these readouts near a lump
Gate valves	@ 750 m	1 Hz		EM-controlled valves; no air
Ion pumps	@ 150 m	1 Hz		Readout at a lump

Cost per lump: Under $10k (corrector scheme not designed, though)

Estimated power at a lump: < 100 W for electronics; add power for correctors.

Communications: With today's technology, Fiber-based Ethernet in a "Star"; Four (4) main routers on the surface each feeding six (6) switches in the tunnel, which in turn feed three (3) lumps. Clock(s) would follow parallel path. High-precision beam-sync clock not needed everywhere, only at high-precision diagnostics. Will research combination of event clock with beam sync clock ring-wide. Estimated cost of computer network: **$225k**. For clock: **$150k**.

Technology is changing rapidly. Need to remain flexible on all aspects here.